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NOTE BY THE SECRETARIAT

Attached is a report, prepared by the Secretariat of the Third United Nations Conference on the Law of the Sea, on problems of acquisition and transfer of marine technology. The report, which is preliminary, is intended to provide some basic information for the use of delegations. It was prepared in compliance with a request made in Sub-Committee III of the Committee on the Peaceful Uses of the Sea-Bed and Ocean Floor beyond the Limits of National Jurisdiction.

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PROBLEMS OF ACQUISITION AND TRANSFER OF MARINE TECHNOLOGY

TABLE OF CONTENTS

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PREFACE

1. The close relationship between marine technology capability and the benefits to be derived from marine resources and the use of the ocean space was recognized by the Committee on the Peaceful Uses of the Sea-Bed and the Ocean Floor beyond the Limits of National Jurisdiction (hereinafter referred to as the Sea-Bed Committee) since its inception. Thus when it was requested by General Assembly resolution 2750 C (XXV) to prepare "a list of subjects and issues relating to the law of the sea" to be dealt with by the Third United Nations Conference on the Law of the Sea, the Committee included "Development and transfer of technology" in the list. Four aspects were singled out by the Committee for consideration:

(a) development of technological capabilities of developing countries;

(b) sharing of knowledge and technology between developed and developing countries;

(c) training of personnel from developing countries;

(d) transfer of technology to developing countries.

2. While the Sea-Bed Committee itself did not discuss the question of transfer of marine technology, it was the concern of both Sub-Committees I and III. In Sub-Committee I, the question was discussed in connexion with the international régime by its working group, which completed a second reading of the four alternative texts on the subject 1/ at the end of its 1973 session. Sub-Committee III established a working group in 1973 to prepare draft treaty articles on scientific research and transfer of technology. The group, however, did not initiate consideration of the transfer of technology. Sub-Committee III itself held a debate on some of the general issues at its July/August session in 1973. 2/

3. During the discussions on this question, several representatives expressed the view that a background paper on the subject might facilitate consideration by the Conference. 3/ A suggestion 4/ was thus made that the Conference be provided with a study which would explore and clarify some of the basic issues and would recommend certain practical measures to promote the transfer of marine technology. The present study represents an effort in this direction and is guided by the views expressed and issues discussed during the Sea-Bed Committee sessions. But since only a few meetings were held on this subject and less than 12 delegations participated in the debate, this source of material is rather limited. 5/

1/ Report of the Sea-Bed Committee on the Peaceful Uses of the Sea-Bed and Ocean Floor beyond the Limits of National Jurisdiction. General Assembly Official Records: Twenty-eighth Session, Supplement No. XXI (A/9021), Vol. II, p. 62.

2/ The discussion is summarized in its report, ibid. Vol. I, pp. 82-84.

3/ See Summary Records A/AC.138/SC.III/SR.41-44.

4/ Ibid.

5/ Most of the discussions are found in summary records of A/AC.138/SC.I/SR.67, pp. 53-54 and A/AC.138/SC.III/SR.41-44, and 49.

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4. It may be recalled that during the discussion, different views were expressed on: whether the inquiry should deal with the technology associated only with activities conducted on the sea-bed, or with activities connected with marine space as a whole; whether scientific and research information should be included; and whether technology transfer should relate to all countries needing such technology regardless of their development status, even though the problems involved may be different for the developed countries. Subsequent discussions in fact covered a very wide range of interests and indicated a preference for a broad, general approach. 1/ Taking into account this indication of preference and the fact that the concern of the Conference is a comprehensive one and that the interests of the participants are very diversified, this paper takes a broad, general view of the subject matter. While the study accords special attention to the problems of the developing countries, it also takes into account problems of the developed countries in this regard, since even among the latter, the need for certain specific marine technology exists and this emphasizes the general interests in the subject.

5. The question of "transfer of technology" in general has received considerable attention in recent years. At the recent sixth special session for example, the General Assembly adopted a programme of action on the establishment of a new international economic order, in which "transfer of technology" formed a part of the programme. In part IV of the programme, it called for, inter alia, the promotion of international co-operation in research and development in exploration and exploitation, conservation and the legitimate utilization of natural resources and all sources of energy. 2/ Several United Nations organs and bodies, including UNCTAD, UNIDO and UNITAR, have undertaken studies on the subject. Their main emphasis, however, has been placed on methodology and guidelines, and such issues as patents, cost-benefit analysis and restrictive business practices. For example, UNCTAD's main concern in this respect is to bring about an improvement in the contractual terms and conditions under which technology in general is transferred to developing countries. 3/ UNITAR has conducted a number of

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1/ See A/AC.138/SC.III/SR.41, 43 and 44.

2/ See General Assembly resolution 3202 (S-VI), Part IV. According to the programme, all efforts should be made: (a) to formulate an international code of conduct for the transfer of technology corresponding to needs and conditions prevalent in developing countries, (b) to give access on improved terms to modern technology and to adapt that technology to specific economic, social and ecological conditions and varying stages of development in developing countries, (c) to expand significantly the assistance from developed to developing countries in research and development programmes and in the creation of suitable indigenous technology, (d) to adapt commercial practices governing transfer of technology to the requirements of the developing countries and to prevent abuse of the rights of sellers.

3/ Among numerous publications of UNCTAD, the following may be cited: "Guidelines for the study of the transfer of technology to developing countries", TD/B/AC.11/9. United Nations, New York, 1972, (Sales No. E.72.II.D.19). "The channels and mechanisms for the transfer of technology from developed to developing countries", TD/B/AC.11/5; "Methodology for studying the transfer of technology, major issues arising from the transfer of technology, progress in implementing Conference Resolution 39 (III)", TD/B/AC.11/L.8; "Restrictive business practices, report by the UNCTAD Secretariat", TD/B/C.2/54 and Corr.1 and Add.1 and 2 and TD/B/C.93 and Add.1.

empirical pilot case studies on the basis of some selected countries in different regions and in such sectors as the semiconductor, petrochemical and pharmaceutical industries. 1/

6. Thus far, no study has been undertaken from the standpoint of "marine technology". As will be seen, marine technology possesses characteristics of its own and raises problems requiring separate investigation. Moreover, transfer of marine technology must be examined in concrete terms in the light of the specific objectives intended to achieve.

7. Several specialized agencies, e.g. IMCO, FAO, WHO and UNESCO, have dealt with certain aspects of marine technology (aquaculture, navigation, fishing, drugs, oceanographic research, etc.). The process of transfer is carried out largely through such means as seminars, exchange of information, training of personnel and provision of experts. Important gaps 2/ are revealed when the existing arrangements within the United Nations system are compared with the spread of marine activities as a whole (see Table I below) and the possible actions that may be taken to further the transfer of marine technology.

1/ These case studies include: "Transfer of technology from Japan to developing countries", by Terutomo Ozawa; "International transfer of automotive technology to developing countries", by Jack Baranson; "The transfer of technology and the factor proportions problem: the Philippines and Mexico", by R. Hal Mason; "The transfer of technology: economics of offshore assembly, the case of semi-conductor industry", by Y. S. Chang; "The international transfer of technology in the establishment of the petrochemical industry in developing countries", by Robert B. Stobauch; "The international transfer of commercial technology to developing countries", by Walter A. Chudson; "Technology transfer in the pharmaceutical industry", by Lawrence H. Watzel; "Soviet experience in transfer of technology to industrially less developed countries", by A. N. Bykov with M. P. Strepetova and A. V. Letenko; UNITAR Research Reports Nos. 7, 8, 10, 11, 12, 13, 14 and 15 respectively.

2/ See paragraphs 59-60 below.

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I. INTROLUCTION

1. The transfer of marine technology is a means of enhancing the capability of technologically deficient countries to carry out the exploration and exploitation of marine resources, and the uses of the ocean space. Marine technology transfer therefore is not an abstract concept but rather a process intended to achieve specific objectives. The design of an effective process of transfer depends, however, on the specific industry or activity for which technology is sought and on the existing local capability.

2. What is meant by "marine technology"? For all practical purposes, "Marine technology" may be understood as the body of knowledge and hardware needed for the uses of the ocean space and for surveying and developing marine resources. In its general sense, it includes such components as: technical information, designs, know-how, engineering, hardware, processing technology, and management. It encompasses the equipment and technical know-how employed in the traditional marine industries such as naval architecture and shipbuilding, fishing or coastal development, as well as in the newer activities of exploration and exploitation of deep sea-bed minerals and hydrocarbons. Table I represents a general indication of the spread of activities under consideration. It will be noted that no attempt is made to establish a rigid distinction between "marine", "coastal" or "estuarine" activities.

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Table I - Marine Activities

I. Exploitation of marine resources	A.	living resources	a. fisheries (e.g. fish and living organisms of the sedentary species) and plants
			b. aquaculture (e.g. oysters, sea weeds, shrimp, salmon, etc.)
			c. extraction of drugs
	B.	mineral resources	a. deposits within bedrock (e.g. oil, gas, sulphur, coal)
			b. surficial and placer deposits (e.g. sand and gravel, phosphorite, iron ores, manganese nodules, tin, gold, etc.)
			c. extraction of dissolved chemicals (e.g. salt, magnesium compounds)
			d. desalination
II. Uses of the ocean space	A.	off-shore structures	a. structures supporting an exploitation process (pipelines, storage tanks, mooring and loading buoys, terminals, etc.)
			b. structures which can conveniently locate facilities off-shore (artificial islands, floating airports, floating (nuclear) power stations under sea habitat, etc.)
			c. structures crossing stretches of water (bridges, pipelines, cables, tunnels, etc.)
	B.	transport	a. ports
			b. tankers
			c. bulk carriers
			d. conventional and container ships
	C.	generation of energy	a. tides
			b. waves
			c. ocean currents
			d. thermal gradients
	D.	others	a. recreation
			b. land reclamation
			c. waste disposal
			d. marine research

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3. The development of marine activities requires considerable technical support, both from the marine sectors and from a large number of non-marine technologies, for instance:

A. Basic research in pure and applied sciences: e.g. an understanding of fluid mechanics is essential in designing on-shore and off-shore structures subject to wave and current forces and for the hydraulic lifting of surficial deposits; underwater acoustics is important in the location and identification of mineral deposits and in fishing; knowledge of corrosion processes is essential for the preservation of all metallic objects placed in the oceans, be they ships, off-shore structures or aquaculture enclosures; meteorology and hydrology are necessary for coastal area development (e.g. off-shore terminals) and so on.

B. Basic technological design, development and other activities: e.g. positioning, platforms and surveys are basic to non-living resource exploration; most marine activities involve aspects of operation, maintenance, design and construction relating to mechanical, electronic and civil engineering.

C. Technical hardware and manpower: the need for expertise and equipment vary according to the activity (e.g. manganese nodule mining, aquaculture, fishing or shipbuilding), the physical conditions of the environment (e.g. depth of water, nature of sea-bed, waves, weather), and the technical and financial capability of the users. In general, the exploitation of a marine resource involves three main stages: prospecting, exploration, and production, and each stage again requires different expertise and equipment. The mining of manganese nodules serves as an example. Mining equipment design varies according to:

(i) type of sea floor sediment and associated engineering properties;

(ii) size of nodules and variation of nodule size;

(iii) nodule concentration and variation of concentration;

(iv) nodule grade and variation of grade;

(v) average and maximum water depth encountered;

(vi) basic features of sea floor topography;

(vii) seasonal sea state and weather; prevailing wind and sea direction;

(viii) required ship endurance, distance from shore facilities for resupply and crew relief;

(ix) daily production rates;

(x) ship or platform manoeuverability and navigation requirements to execute mining plan and launch and retrieve system;

(xi) marine ecology requirements.

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4. Most marine activities have an overriding demand for power, navigation, survey and data collection on the one hand, and for management and training on the other. A successful operation of marine activities requires a critical mass of properly trained manpower, both technicians and scientists, and indigenous facilities for the education and training of supporting personnel.

5. The term "transfer of marine technology" is often subject to different interpretations. In some instances it is used to describe the flow of scientific information, technical assistance programmes or the training of personnel. In others, the emphasis is on the interactions of related disciplines: e.g. aquaculture benefits from scientific advances in fish genetics; deep-sea nodule mining benefits from understanding the ocean mineral precipitation process. Some also refer to the transfer of techniques from one field to another. Thus, for example, much has been said about the applicability of space technology to ocean space: 1/ meteorologic satellites, continuously observing global weather patterns, obtain critical forecasting data from unpopulated oceanic regions; remote sensing satellites survey marine resources. Still others use the term to mean the conversion of technologies developed for military purposes to peaceful uses. 2/

6. For the purpose of this paper, transfer of marine technology is viewed as (i) a process of making available to the countries needing it the relevant technology for the better use of marine resources and environment, and (ii) as a process of implanting such technology in the recipient country. Accordingly, two aspects are involved: acquisition of marine technology and the application of such technology by the recipient. The aim of marine technology transfer is therefore to get a specific ocean industry working in the recipient country, and concurrently to enable the country to achieve a certain amount of technological autonomy in terms of skill, know-how and trained personnel so that it can make its own technological decisions with full awareness of what is available.

7. An important component of any programme of technology transfer is the determination of the "appropriate technology". Very often the most modern equipment, the most sophisticated techniques or the most up-to-date expert are not necessarily the best choice for the needs of some developing countries. Perhaps a simpler technology might be more appropriate for the scale of operation envisaged or for the level of skills of the local labour force.

1/ See, for example, J. G. Wenzel, Ocean Technology Transfer, in Proceedings, Marine industries problems and opportunities. Marine Technology Society, Ninth Annual Conference, 1973, pp. 141-146.

2/ See, for example, E. Clausner, Navy's undersea technology programme: Marine Industries the Beneficiary, ibid., pp. 133-140.

II. METHODS OF ACQUISITION AND TRANSFER OF MARINE TECHNOLOGY

8. Methods of acquisition and transfer of marine technology are closely associated with the type of capability that the recipient country desires to acquire. In some cases, the technology being considered may be available in a variety of forms, differing greatly for example in the technology-capital-labour ratio. This is the case, for example, with fishing, aquaculture or salt extraction. In other cases, such as oil and gas production or power generation, there is much less choice of technology; the characteristics and location of the marine resources may, to a large extent, fix the technology which must be used. For example, depth of water, weather, distance from base and nature of the sea-bed will primarily determine the type of technology required. Some choices remain - as for instance in the transportation of oil and gas ashore, whether by pipeline or tanker.

9. Once the type of technology required is decided, three basic methods could be used to acquire the technology: (a) develop it locally without outside assistance; (b) develop it locally, but with some outside help, whether in terms of information, expertise or equipment, or (c) acquire it completely from abroad. The advantages and disadvantages of each method are obvious: the degree of local control is in proportion to the amount of local contribution: the greater the external contribution is, the less is the likelihood of local control. This could further be illustrated by using some of the variant forms of the second and third methods:

(a) develop required capability locally, making use only of freely available information and expertise;

(b) develop it locally, using some hired expertise from abroad;

(c) purchase the necessary capabilities in manufacturing and/or research and/or training, then develop equipment and expertise locally;

(d) purchase or lease some equipment and expertise from abroad, develop others locally;

(e) purchase or lease most or all of equipment and expertise from abroad;

(f) exchange a share in the resource to be exploited for equipment and expenditure;

(g) lease rights to exploit the resources to foreign capital and technology.

10. The decision to choose any of these variants depends on a number of factors, including the national policy, nature of the technology and the technical capability of the country. These considerations will be further illustrated.

11. Variants (a) to (d) would provide greater local control, whereas the employment of variants (e) to (g) per se, which usually involve foreign investment, licensing agreement, or co-operative ventures, would result in very little local control. Although variants (e) to (g) may be effective ways to physically acquire equipment and know-how, some safeguarding and phasing-out policies would be necessary to effect the transfer of the technology and also to protect national interests. These may include the requirement of

the supplier to utilize local material and manpower and to organize training programmes for local staff to ensure a gradual and systematic replacement of the external personnel in expertise, technical operation and management. The implementation of such policies could be strengthened by gradually restricting or reducing foreign shareholding in or profit-making from the enterprise.

12. Technology is generally bought and sold in the world market in the form of information (e.g. designs), capital goods (e.g. equipment and machinery), or skilled manpower, and such components are generally subject to proprietary rights and are sold under restrictive conditions. The more modern and sophisticated the technology - as is the case with much marine technology - the more likely it is that the devices and processes are patented by individuals or corporations which are often multinational in scope. 1/ There is a high chance therefore that certain technological components will have to be obtained by foreign investment or a co-operative venture. On the other hand, if the recipient has partial familiarity with the specific technology required and has the technical and industrial capability to apply it, the development can often be promoted by using some hired expertise or purchasing or leasing some equipment from abroad. For example, the need for shrimp processing techniques in certain Latin American countries could probably be met by the services of technical advisers, licensing or importation of equipments, whereas the need for fish preservation techniques in the Bay of Bengal might require further research and the adaptation of technology which could be applied economically in the area; in the North Sea, a capabilty in offshore structure may be developed from a previous familiarity with onshore construction methods.

13. If it is decided that the technology required should be acquired from abroad, various arrangements can be made: (a) a package deal directly from a foreign supplier, (b) separately item by item, or (c) partly by package and partly by individual acquisition.

14. (a) If the establishment of an industrial project involves recently developed or sophisticated machinery and technical know-how, as in manganese nodule mining, there is a strong tendency that the project would entail a package deal involving licence contract, equity control or majority participation. The reasons are not difficult to find. Such technologies are likely to be an important source of monopolistic advantage and are the source of bargaining power for the supplier. They may also represent a large recent investment which has yet to be recouped. Suppliers possessing such technologies may wish to maintain a considerable measure of control over the operation and large companies carrying on activities on an international scale are often anxious to have such control. Even in some cases where the technology involved is not recent or sophisticated, because of the lack of appropriate technical infrastructure and managerial skill in the recipient country, the recipient may wish to obtain a package deal, hoping thereby to minimize the risk of an unsuccessful operation.

15. Under this package arrangement, the foreign supplier would provide the various elements of technology as a package and, if necessary, take upon itself to subcontract the supply of the various elements of technical knowledge needed.

1/ See also paragraph 27, foot-note thereto.

16. Consider an off-shore oil drilling project for example: a foreign entrepreneur - usually an oil company acting in the capacity of an operator - would be given the responsibility for the whole process from geophysical survey to production, and from obtaining the machinery and equipment to managing the new enterprise. All the technical know-how and hardware required at every stage and phase of the project would be provided through the foreign entrepreneur.

17. This kind of arrangement often involves investment by a foreign enterprise which may establish in the recipient country a subsidiary or affiliate with varying degrees of autonomy. The recipient usually has little direct control over the operation but can become involved in the activities by requiring the foreign operator to use local services, equipment and manpower whenever technically and economically possible.

18. (b) On the other hand, a marine industrial project could be established through, for example, a public sector enterprise which could acquire on the most advantageous terms the elements of technology directly from the sources of supply. Public enterprise, as the name suggests, is designed for the maximum participation of the recipient. But an effective arrangement presupposes both the availability of finance and an appropriate technological capability and infrastructure.

19. (c) In reality, many projects are carried out through various forms of co-operative ventures in which the public and private sectors of the technology supplier and the recipient participate in varying degrees in the provision of skills, machinery, capital and in management control. Often, some of the elements are acquired as a package and others individually from the sources of supply. Thus, in a project for coastal area development involving construction of off-shore terminals, a consultant agent from country "A" may be contracted to acquire as a package the critical information on bottom topography, conditions of wind, waves, tides and subsurface currents of the coast, whereas an engineering firm from country "B" may be engaged to design and construct the terminals using mostly local manpower and materials. At the same time, the project may use United Nations technical assistance for the training of management personnel. In any civil engineering contract such as the example above, and in many other situations, it would be common practice for the country concerned to appoint a third party (e.g. an overseas consultant) to act on its behalf in managing and overseeing the contract. This again provides some measure of protection to a country not able to make its own technological assessments.

III. OBSTACLES AND PROBLEMS OF ACQUISITION AND TRANSFER OF MARINE TECHNOLOGY

20. Although many marine activities such as fishing and transport have long histories, further development and better application remain a priority even among the technologically more advanced countries. Certain uses (e.g. waste disposal) have only quite recently assumed importance, others, such as desalination are still in the development stage, and activities such as off-shore drilling are being modified to take them into deeper water and more extreme environments. Still others, such as deep-sea mining, are new activities born of greater scientific knowledge and modern technological advances. But with very few exceptions, activities in ocean space have expanded considerably in recent years and the value of marine resources and uses has increased as a consequence. Gaps and inadequacies are not uncommon in marine technology, though the extent of the deficiency may vary from one industry to another. 1/ The need for marine technology also exists even among the developed countries, particularly in those more recently emerged activities just mentioned. 2/ There is therefore a need to promote the development of marine technology in general.

21. Since much equipment and machinery has been designed for use under certain conditions, and the application of equipment and know-how is affected by the environment in which it is applied, it cannot be assumed that equipment which was developed in one area can be effectively applied in another area without adaptation. For example, drilling rigs and off-shore structures designed for use in the Gulf of Mexico are inappropriate to operate in the hostile environment of the North Sea. It may be even less than ideal for use in the different economic, social, technical, physical and other conditions in a developing country. These factors increase the difficulties in marine technology transfer.

22. Marine industries, as shown here earlier, 3/ cover a very wide range of activities. In so far as transfer of the relevant technologies is concerned, different marine industries involve different problems depending on the nature and characteristics of the industry. Generally speaking, technology requirement becomes more stringent, complex and demanding as water depth increases and as the activity extends farther from shore. Thus, deep-sea mining of manganese nodules involves far more sophisticated equipment and technical knowledge than near-shore sand and gravel extraction; pelagic fishing requires larger and more advanced facilities than coastal fishing. As technology becomes more sophisticated, the operation also becomes more capital-intensive. This is a factor which must be duly recognized in selecting marine industries for development.

1/ See D. E. Kash, et. al. Energy under the Oceans; a technology assessment of outer continental shelf oil and gas operations. University of Oklahoma Press 1973, pp. 114-136; Wang and Cruickshank, "Technologic gaps in exploration and exploitation of sub-sea mineral resources", Offshore Technology Conference, Houston, 1969, pp. 85-98.

2/ See for example J. W. Pendered and R. E. Taylor, "Education for the Offshore Industry in Europe", in 1974 Offshore Technology Conference, preprints Vol. 1, pp. 513-521.

3/ See table I, paragraph 2 above.

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23. On the other hand, within each marine industry there are different approaches to development, and different levels of technology can be applied. It is not always possible to say which might produce the best results, though some methods are more suitable than others in certain situations. In fish-farming, for example, completely enclosed systems used in some countries for the cultivation of plaice are capital-intensive and therefore most suitable for industrialized countries; on the other hand, systems for fertilizing coastal water or for farming in lagoons or coastal waters with simple enclosures involving only moderate investment but considerable labour may be suitable for labour-intensive economies.

24. Certain marine activities require not only advanced technology and the expertise of several disciplines but also large and long-term investment, with returns delayed by several years. For example, surveys of manganese nodules require expertise in several disciplines and the use of very sophisticated instruments to obtain accurate records of the ship's position when photographs or samples are taken. At the production stage, it has been reported that the construction of a commercial scale nodule mining system and metallurgical plant could amount to more than $200 million. 1/ A self-elevating, jack-up type of off-shore drilling platform designed to operate in water depths up to 250 metres under hurricane conditions would cost $US 25 million (if built in the United States). 2/ Daily costs for operating and supporting one of the new semi-submersible rigs total about $50,000. 3/

25. On the other hand, certain uses and activities such as sand dredging or construction of off-shore terminals are comparatively speaking, less capital-intensive and could be achieved in many cases with an intermediate level of technology.

26. A successful transfer presupposes that the recipient has the capability to determine what is needed and to apply subsequently the technology acquired. These are questions of selection and application. So far as selection is concerned, the recipient needs to determine, as mentioned earlier, the nature and extent of its resources and, based on this, the kind of marine industry that it intends to develop (e.g. off-shore gas), to identify the priority areas where specific technologies are needed (e.g. pipe installation) and to obtain the appropriate know-how and machinery to carry out the

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1/ "Sea-bed mineral resources: recent developments", progress report by the Secretary-General, A/AC.138/90, 3 July 1973, p. 12.

2/ Ibid., p. 6.

3/ While there is no information available on the total costs involved in marine technology transfer, a calculation relating to only two types of cost (i.e. royalties and technical fees) puts expenditure on the import of technology in general by developing countries in or around 1968 at about $1,500 million, a figure equal to 5 per cent of the exports of developing countries (excluding major oil exporters) and 40 per cent of their debt-servicing costs. On the same basis, it is estimated that these payments for technology alone are likely to increase by approximately 20 per cent per annum during the [illegible] a gross rate which implies annual payments of roughly $9 billion by the end of the decade. See United Nations document "Transfer of technology report", UNCTAD secretariat TD/106, paras. 35-36 and statements in Sub-Committee III of the Sea-bed Committee by the representatives of Pakistan and Venezuela, A/AC.138/SC.III/SR.43.

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project. Due to the general low levels of economic activity and technological sophistication and of the scarcity of skills, developing countries are often inadequately equipped to meet these requirements. Moreover, the recipient often lacks the essential information (e.g. state of the art and the firms and companies capable of providing the service or equipment) upon which some of these decisions are to be based. As to application, even when the required technology is made available, there are still problems of operation, management and marketing to overcome.

27. In projects involving scientists from various disciplines and large-scale equipment and machinery (as in the nodule mining industry), the freedom to seek different sources of development assistance tends to be limited to the early stages of the project. After feasibility studies, market surveys and the key technical decisions have been made, little choice is left regarding the sources of technology and the know-how needed for engineering, construction, management, operation and for marketing the output. The outcome of the negotiations on the terms and conditions for the import of equipment and machinery depends, to a considerable degree, on the negotiating power and the scope of technological information available to the recipient at the initial stage of the project. When advanced technologies, such as those for deep-sea mining, are in the hands of a small group of companies operating on a multinational basis, 1/ the bargaining advantage is likely to be on the side of the supplier.

28. Under present market conditions, 2/ the suppliers of technology are in a strong position to dictate terms and conditions. They aim to yield high rates of return which take the form not only of profits earned on equity (if the supplier holds shares in the recipient enterprise), but also of all profits earned from sale of machinery, equipment, spare parts and technical services to the recipient. The supplier can earn these high profits and protect his competitive position both by limiting the commercial freedom of the recipient through restrictive conditions in the licence contract and by his ability to switch from one method for profit collection to another with relative ease. There is also some evidence that package deals involving proprietary processing technology have involved restrictions on the commercial activities of the recipient and that these restrictions have been used to maintain high prices for intermediate goods and components.

29. There is also the problem of markets. Consider mineral production as an example. In the majority of developing countries, the internal market for key minerals produced

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1/ These include, for example, Summa Corporation (ex-Hughes Tool Corp.), Kennecott Copper Corporation, Deepsea Ventures Inc. (an affiliate of Tenneco), International Nickel Corporation, Summitomo Group/MITI, West German Arbeitsgemeinschaft Meerestechnischewinnbare Rohstoffe (AMR), Centre National pour l'exploitation des oceans (CNEXO) and Societé de Nickel of France. For their recent activities see Economic Implications of Sea-Bed Mineral Development in the International Area: report of the Secretary-General, A/CONF.62/25, 22 May 1974, pp. 12-22.

2/ This part is based on Guidelines for the study of the transfer of technology to developing countries, TD/B/AC.11/9, United Nations, New York, 1972 (Sales No. E.72.II.D.19), chapter I, pp. 6-8.

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domestically thus far is very limited. Efficient exploitation requires ready access to export markets. Export markets, however, are often dominated by large, vertically integrated enterprises which control the production of the minerals. Dependence on foreign technology, investment and export markets is not unique to developing countries; certain developed countries are faced with the same problem. However, since in the case of developing countries, the flow of technology is usually one way, the limitations of the market mechanism are compounded.

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IV. WAYS AND MEANS TO ENHANCE TRANSFER OF MARINE TECHNOLOGY

30. A spectrum of measures may be suggested for the purpose of promoting the transfer of marine technology. They are by no means exhaustive. These measures deal specifically with information needs and with problems related to the demand for expertise, equipment, training and education. They can be implemented individually or jointly, and at different levels - nationally, regionally and internationally, through the United Nations system. Measures which are particularly suitable for action at the regional, subregional or international levels are further elaborated at the end of this section.

A. Information needs

31. While there is an immense amount of scientific and technical data and information relevant to marine technologies, there is a need to prepare a user's guide to the many marine science and technology information services already in operation. Such a guide could also provide information on research and training institutions and the availability of consultancy services and on manufacturing firms, service organizations, engineering firms, construction companies, drilling companies, equipment lease and rental firms and the like. A collection of this information would facilitate the acquisition of the basic knowledge upon which some fundamental decisions must be made, and would also presumably help in negotiating processes, possibly leading to a more favourable recipient basis for transfers.

32. In addition, such a guide would reveal what special data are needed and in what areas, the mere publication of which could boost the necessary action required.

B. Measures to meet the need for expertise and equipment

33. Consideration should be given at two levels: those activities which require a high level of marine technology; and those areas where less sophisticated expertise, machinery and equipment suffice.

34. Perhaps with the exception of sand and gravel dredging, activities involving mineral resources exploitation generally require a high or a very high level of technology, specialized personnel (e.g. marine geologists, drilling experts and mechanical engineers), heavy equipment and machinery, and a large financial investment. An effective way to acquire the technological know-how is of course actually to develop such industries by the country itself, but the time scale of this would depend upon the state of existing technology in the country. For many developing countries, a possible way to meet the technological and financial requirements on a more reasonable time scale might be to obtain external assistance. While many forms of such assistance may be envisaged, co-operative ventures with foreign entrepreneurs may be mentioned here.

35. Co-operative ventures with foreign entrepreneurs could provide the host country on the one hand with an opportunity for direct participation in resource exploitation and on the other, with the required technological know-how, machinery and capital.

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36. Since, as mentioned earlier, 1/ uncontrolled foreign participation and investment in local enterprises can have harmful effects on national economy, it is clearly desirable to consider implementation of effective control measures at the same time. To some extent these measures could take the form of setting limits on foreign shareholding and by establishing laws and regulations to prescribe the conditions under which external enterprises are allowed to operate. Such regulatory measures would be maintained to ensure that foreign enterprises would serve the national economy and interests.

37. While external participation and investment may appear to be an effective means for mobilizing technology and finance, it does not necessarily follow that the technology is automatically transferred to the host country. Measures for realizing the actual transfer to the host country - that is, its implantation - must be taken. One possibility is to provide an effective built-in mechanism in the co-operative arrangement. This may include the obligation of foreign entrepreneurs to organize programmes for training host country staff to become competent technical and managerial personnel, a gradual and systematic replacement of the foreign entrepreneurs' personnel by indigenous staff, and a gradual reduction in the shares held by external participants. These and other measures could be introduced to ensure and increase participation of developing countries in the conception, construction, organization and management of the enterprises.

38. In some cases, efforts to speed up the transfer of technology to the recipient may not result in the maximum direct financial benefit from the resource exploitation to the country concerned. More effective transfer may result from a slower development or from the use of less sophisticated and cheaper technology. In general, a trade-off exists between the speed of resource exploitation and the effective transfer of marine technology.

39. As to the institutional aspects of the venture, one possible approach might be to establish a corporation between the host country, which may be represented by a national company, and one or several foreign entrepreneurs. The host country would permit the company to exploit the resources and would hold a half or a majority share in the venture. The remaining part would be granted to the foreign entrepreneurs in return for their contribution of technology, investment and management.

40. Co-operative ventures may prove useful for regional undertakings, particularly in circumstances where the mineral resources are linked by contiguity or other ties. Participants in the joint operation could include not only national and international agencies but also public development corporations and private companies. Shares would be held by participants in proportion to the degree of their involvement or according to some other criteria agreed upon among the parties. During the recent Sixth Special Session of the General Assembly, several delegates commended this approach and pointed out specifically that this technique could be beneficial in regard to the interchange of relevant technologies. 2/

1/ Paragraphs 9-11 above.

2/ See, for example, A/PV.2224, p. 41, A/PV.2211, pp. 63, 64-65.

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41. While these and other forms of co-operative ventures at national or regional level may prove useful instruments, careful study is needed to determine the terms and conditions under which a co-operative venture could work best for the economy and further transfer of marine technology.

42. The formulation of appropriate policies to encourage foreign participation and investment in the priority sectors where technical know-how and machinery are needed can certainly influence the investment decisions of foreign entrepreneurs. This purpose could be facilitated by establishing a list of foreign firms and companies specialized in the types of technical information or engineering hardware that are needed. Governments may consciously encourage negotiations aimed at obtaining foreign technology in those sectors. Foreign investment or co-operative ventures in priority sectors could also be given special consideration or favourable treatment. For example, special incentives such as tax exemption, investment allowances and the like may be considered. Adequate safeguards and allowances on the proportion of net sale or total output which can be paid in royalties and licence fees are also attractions to foreign suppliers.

43. Turning now to those areas where less sophisticated and less expensive machinery and equipment should be developed, some illustrative examples are: processing, handling and preservation of fish and other marine resources; biological and chemical monitoring techniques for aquaculture; construction of boats and simple marine structures; small engines for fishing boats and ferries; sand and gravel dredging and the exploitation of other beach mineral deposits; new techniques in fishing or seaweed harvesting; local waste treatment schemes to prevent damage to tourism and living marine resources; recovery of salt and other chemicals; and desalination, possibly using solar stills.

44. A detailed description of equipment and machinery needs arising from these specific uses of the sea could be prepared for the information of users. Such a study should give special attention to a range of valuable intermediate technologies and to situations in which comparatively simple and inexpensive equipment and machinery could increase efficiency.

C. Training and education

45. Although there is a felt need in developing countries for training and education in marine science and technology, the areas of special training needed in marine technology should be identified and investigated. A list of priorities should be established. The United Nations, the specialized agencies and other education and training establishments throughout the world could then be encouraged to offer courses to meet identified needs.

46. It seems equally important that the coverage of existing courses in this field should be catalogued, firstly, to avoid duplication of effort and secondly, to give developing countries the information on where best to send their students for overseas training. This should perhaps form an important section of the "user's guide". 1/

1/ See paragraph 31 above.

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47. Since at present marine technology firms and organizations already accept students for periods of time during degree or other courses of study, similar arrangements might be made for accepting trainees from developing countries. The United Nations could disseminate details of such organizations and training programmes.

48. During the Sea-Bed Committee's discussions, a number of countries 1/ already indicated their readiness to expand education and training programmes in marine science and technology. Such programmes might be organized by and administered through the United Nations and the specialized agencies, if it is so desired.

D. Possible action at regional and subregional level

49. Certain more specific measures which may be taken at the regional level (e.g. co-operative ventures) have already been mentioned in connexion with the need for expertise, equipment and machinery. Here are certain illustrative examples of possible action which may be envisaged.

50. The feasibility of any regional or subregional action presupposes a viable or "co-operative" political atmosphere within a region and common understanding of the problem. The possibility of establishing regional marine technology institutes may be explored. 2/ Such institutes could utilize the combined resources and capability of the region to build up appropriate equipment and machinery; to establish education and training facilities to meet the needs in marine activities (e.g. regional maps and a data bank covering all information relating to the geology and mineral potential of coastal and continental margins) and to support a marine technology programme (e.g. coastal area development) in the interests of the participants. In this way, the common requirements of a group of co-operating countries in various scientific and technical areas could be met much more efficiently than if each country tried to establish a marine capability in every subject of interest. Also, in this way, countries could utilize the institute for specific projects of national concern.

51. A number of other forms of regional co-operation may also be explored. For example, countries in a region may establish a common objective in marine resource exploitation (e.g. off-shore oil production) and draw up a stage-by-stage implementation plan. As a first stage, each would specialize in one or a number of chosen areas (e.g. divers, geologists, petroleum engineers, drilling technologists or biologists). The pooling of the expertise from the participants would constitute a nucleus for joint action.

52. Another possibility would be to promote mutual assistance and to utilize expertise which can first be found within the region. Thus, it might be possible in Latin America, for example, for a neighbouring country which desires to develop its capability in seismology to request assistance from Colombia, which is known already to have a well-developed seismology programme, instead of engaging an expert from outside the region who may not be familiar with Latin American areas and the technical and scientific resources of that region.

1/ See summary records, A/AC.138/SC.III/SR.42.

2/ During the discussion held at the Sea-Bed Committee, such a view was expressed by several delegates (see A/AC.138/SC.III/SR.49).

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53. As mentioned before, regional or subregional action may prove useful particularly in circumstances where the resources are linked by contiguity. Coastal area development 1/ is another example possessing such characteristics and is conducive to action at a regional level, given the necessary elements of political support and common interests.

E. Appropriate actions which may be taken by the United Nations

54. Although certain aspects of marine technology fall within the regular activities of several specialized agencies, the scope of the activities is still very limited. Many new areas of marine resource exploitation and uses of ocean space remain outside the present framework. A detailed account of the activities and terms of reference of all United Nations bodies concerned from the standpoint of transfer of marine technology is needed. Such an account would reveal gaps and inadequacies in the existing arrangements so that appropriate action could be contemplated. 2/

55. On the basis of a preliminary evaluation of the present activities in the United Nations system alone, the following areas may be singled out to illustrate present needs.

56. Realistic and well-designed plans to develop and operate a capability in a marine activity for which demand can be demonstrated would be likely to attract investment capital in any country, developed or developing. The United Nations and its specialized agencies can help in formulating such plans.

57. There are obvious needs for expert services to discover and inventory the marine resources and their market, and for data services in obtaining, selecting and evaluating the mass of data of possible relevance to development of marine technology capabilities. Services of this kind are of general interest and are beneficial to many interested countries. They are, however, economically high risk activities, 3/ which might otherwise not be carried out.

1/ Mention may be made of resolution 1802 (LV) of the Economic and Social Council which, in part II, requested the Secretary-General to prepare a comprehensive interdisciplinary study to identify and review the problems of coastal area development and to make proposals for possible appropriate action at the regional and subregional levels.

2/ In part I of Economic and Social Council resolution 1802 (LV) of 7 August 1973, the Secretary-General was requested to include in his report on the uses of the sea a survey of the existing arrangements in the United Nations system for making available to interested countries, particularly the developing countries, information on advances in technology and the transfer of such technology to them. The report is to be submitted to the fifty-ninth session of the Council in 1975. It would appear that the information requested by the Council could also be useful for the consideration of the Conference.

3/ Although initial survey for some marine resources need not be very expensive, particularly if expertise is available locally, the cost of proving a reserve may be great - as much as 10 per cent of the total cost of extracting the resource.

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58. The preparation of a user's guide on Marine Technology may provide a useful working tool and could also meet the special needs for information and knowledge regarding services, equipment, machinery and techniques mentioned earlier. Such a guide would be designed primarily for policy-makers and managerial personnel in the developing countries who are involved in the uses of marine resources and ocean space. It could provide a stage-by-stage description of the alternative methods and technological requirements in establishing a marine activity (e.g. oil, gas, nodules, fishing, agriculture, shipping and so on). Sources of supply of the various technologies, equipment and services, and economic considerations such as cost and benefit and market situations could also be included.

59. A preliminary survey indicates that there is sufficient information readily available for preparing a marine technology guide outlined above. The United Nations and its specialized agencies could be given sections (e.g. fisheries, shipping, and drugs) of the guide according to their expertise and competence. In fact, several specialized agencies have already prepared studies of similar kind in the conduct of their regular activities: thus, for example, FAO for fishing technology; IMCO for use and testing of sea-borne navigation equipment; WHO for drugs from marine organisms; IAEA for safety evaluation of nuclear merchant ships; UNESCO for marine data inventory.

60. But, on the other hand, initiatives have yet to be taken regarding such marine activities as off shore oil and gas, deep sea mining, salvage, off-shore structure, land reclamation, extracting dissolved chemicals, recreation, undersea habitats and sand and gravel dredging. Action in these areas would fill important gaps in the dissemination of knowledge of and application of marine technology.

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V. SUMMARY OF SUGGESTIONS CONTAINED IN THE PRESENT PAPER

61. The summary given below covers the principal suggestions made in this paper concerning possible action for enhancing the transfer of marine technology. At the present rather elementary stage of development of study of this subject, these suggestions are obviously bound to be of an exploratory and illustrative nature.

I. Information needs: a descriptive introduction of the kind of services, products, etc. available from consultancy services, manufacturing firms, service organizations, engineering firms, construction companies, drilling companies, equipment lease and rental firms.

II. Needs for expertise and equipment:

(i) For activities requiring a high level of marine technology and large investment 1/ the feasibility of establishing co-operative ventures be further examined; to propose terms and conditions under which such a venture would best work for national economy and further transfer of marine technology; to elaborate methods for the implantation of marine technology in recipient countries.

(ii) For activities requiring less sophisticated and less expensive machinery and equipment 1/ preparation of technical guide books describing in detail equipment and machinery needs, paying special attention to a range of valuable intermediate technologies and to situations in which comparatively simple and inexpensive equipment and machinery could increase efficiency.

III. Training and education:

(i) Identification and investigation of training needs in developing countries; United Nations, specialized agencies and other education and training establishments be encouraged to offer courses to meet the needs.

(ii) Promotion of training programmes given by marine technology firms and organizations; United Nations to disseminate details of such available programmes.

IV. Possible action at regional and sub regional level:

(i) Exchange of information relating to marine technology.

(ii) Setting up regional marine technology institutes.

(iii) Regional co-operative action: drawing up common objectives (e.g. off-shore oil production) and each participant to specialize in one or a number of chosen areas (e.g. divers, geologists, petroleum engineers, drilling technologists); pooling specialization for the implementation of the common objective.

(iv) Mutual assistance and utilization of expertise in the region.

1/ The division is made on a comparative basis and is therefore relative.

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V. Possible United Nations action:

(i) Preparation of user's guide on marine technology for policy-makers and managerial personnel; providing stage-by-stage description of alternative methods and technological requirements regarding such activities as oil and gas, deep-sea mining, salvage, off-shore structure, land reclamation, extracting dissolved chemicals, desalination, recreation, etc.

(ii) A detailed account of activities and terms of reference of all United Nations bodies concerned from the standpoint of transfer of marine technology.
